I claim:

1. A method for reducing the crest factor of a signal, said method using a plurality of partial correction signals having respective predetermined frequencies,

said method comprising, for each one of said partial correction signals, the steps of
(a) determining a time position of a maximum absolute amplitude of the signal,
(b) calculating an amplitude and a phase for the respective partial correction signal depending on said maximum absolute amplitude and said time position determined in step (a),
(c) subtracting the respective partial correction signal from said signal to obtain a partially corrected signal which is used as the signal in step (a) for the next one of the plurality of partial correction signals, and returning to step (a) for calculating an amplitude and a phase for the next partial correction signal,
said method furthermore comprising the step of
(d) outputting the last obtained partially corrected signal as the corrected signal having the reduced crest factor.

2. The method according to claim 1, wherein instead of step (d) the steps of

(d1) calculating a full correction signal as a superposition of said plurality of partial correction signals,
(d2) subtracting the full correction signal from said signal to obtain the corrected signal having the reduced crest factor, and
(d3) outputting said corrected signal
are performed.

3. The method according to claim 1,

wherein steps (a) to (c) are repeated for at least two iterations for each one of the plurality of partial correction signals.

4. The method according to claim 3, where a maximum number of iterations is predetermined.

5. The method according to claim 3,

wherein steps (a) to (c) are repeated for each one of the plurality of partial correction signals until a maximum absolute amplitude of the partially corrected signal is below a predetermined value.

6. The method according to claim 3,

wherein in step (b) the calculated amplitude and phase values are stored, and

wherein step (d) is replaced by the steps of

(d1) calculating a plurality of further partial correction signals having the respective predetermined frequency, each one as a superposition of the partial correction signals having the respective predetermined frequency in the stored phases and amplitudes calculated in steps (d) for this frequency,

(d2) subtracting the plurality of further partial correction signals from said signal to obtain the corrected signal, and

(d3) outputting said corrected signal.

7. The method according to claim 1,

wherein step (b) comprises the steps of

(b1) calculating said amplitude according to

$$A = g \cdot \left(\max\{x(t) \cdot \cos(2\pi f(t - t\max))\} + \min\{x(t) \cdot \cos(2\pi f(t - t\max))\}\right),$$

A being the amplitude, g being a predetermined factor, f being the respective predetermined frequency, t being the time, $t\max$ being said time position and $x(t)$ being said signal, and

(b2) calculating said phase p according to $p = 2\pi f \cdot t\max$

8. The method according to claim 1,

wherein the signal is a sampled signal represented as a signal vector of N signal values at N sampling times.

9. The method according to claim 8,

wherein step (b) comprises the steps of

(b1) calculating said amplitude according to the formula

$$A = g \cdot \left(\max\{x(k) \cdot \cos(2\pi\mu(k - k\max)/N)\} + \min(x(k) \cdot \cos(2\pi\mu(k - k\max)/N)\}\right),$$

A being the amplitude, g being a predetermined factor, μ being a number of the respective predetermined frequency, k being a number of the sample, $k\max$ being this number of the sample at said time position, and $x(k)$ being a k-th component of said signal vector, and

(b2) calculating said phase p according to $p = 2\pi\mu \cdot k\max/N$.

10. The method according to claim 9,

wherein values for μ have the form $2^{\ell} \cdot \nu$, ℓ and ν being integer numbers.

11. The method according to claim 9, wherein cosine values of the formula are calculated using a sine or cosine table.

12. The method according to claim 1,

wherein the signal is a multi-carrier signal.

13. The method according to claim 12,

wherein the signal is a discrete tone modulated signal.

14. The method according to claim 1,

wherein, when the maximum absolute amplitude determined in step (a) is below a predetermined value, steps (b) to (d) are omitted and the signal is output.

15. The method according to claim 8,

wherein said method, before step (a), comprises the steps of

(a1) forming a first auxiliary vector containing as elements M signal values having the M largest absolute values of the N signal values, M being smaller than N,

(a2) forming a second auxiliary vector indicating the positions of the elements of the first auxiliary vector in the signal vector,

wherein steps (a) to (c) are performed on the first auxiliary vector instead of on the signal using phase information of the second auxiliary vector, and

wherein, instead of step (d), the following steps are performed:

(d1) calculating a correction vector for the signal vector based on said amplitudes and said phases calculated in step (b) translated to phases for the signal vector using the second auxiliary vector,

(d2) subtracting said correction vector from said signal vector to obtain a corrected signal vector, and

(d3) outputting a signal corresponding to said corrected signal vector as the corrected signal having the reduced crest factor.

16. The method according to claim 15, wherein step (b) comprises the steps of

(b1) calculating said amplitude according to

$$A = g \cdot \left(\max\{xm(k) \cdot \cos(2\pi\mu(pm(k) - pm(k\max))/N)\} + \\ + \min\{xm(k) \cdot \cos(2\pi\mu(pm(k) - pm(k\max))/N)\}\right),$$

A being the amplitude, g being a predetermined factor, μ being a number of the respective predetermined frequency, k being a number of the sample, $k\max$ being the number of the sample at said time position, $xm(k)$ being element k of said first auxiliary vector, $pm(k)$ being element k of said second auxiliary vector, and

(b2) calculating said phase p according to $p = 2\pi\mu \cdot k\max/N$

17. The method according to claim 15, wherein steps (a1) and (a2) comprise the steps of:

(aa1) assigning the M last elements of the signal vector to elements of the first auxiliary vector,

(aa2) assigning the M last sample positions of the signal vector to the elements of the second auxiliary vector,

(aa3) setting a counter to 0,

(aa4) determining the element of the first auxiliary vector having the smallest absolute amplitude,

(aa5) incrementing the counter by 1,

(aa6) checking if the element of the signal vector designated by the counter has a larger absolute amplitude than the element of the first auxiliary vector having the smallest absolute amplitude, and, if not, returning to step (aa5),

(aa7) replacing the element of the first auxiliary vector having the smallest absolute amplitude by the element of the signal vector designated by the counter, and replacing the corresponding element of the second auxiliary vector by the counter,

(aa8) returning to step (aa4) until the counter has reached $N - M$.

18. An apparatus for reducing the crest factor of a signal using a plurality of partial correction signals having respective predetermined frequencies,

said apparatus comprising processing means designed to carry out, for each one of said partial correction signals, the steps of

(a) determining a time position of a maximum absolute amplitude of the signal,

(b) calculating an amplitude and a phase for the respective partial correction signal depending on said maximum absolute amplitude and said time position determined in step (a),

(c) subtracting the respective partial correction signal from said signal to obtain a partially corrected signal which is used as the signal in step (a) for the next one of the plurality of partial correction signals, and returning to step (a) for calculating an amplitude and a phase for the next partial correction signal,

said apparatus further comprising

output means for outputting the last obtained partially corrected signal as the corrected signal having the reduced crest factor.

19. The apparatus according to claim 18, wherein the outputting means are designed to carry out the steps of

(d1) calculating a full correction signal as a superposition of said plurality of partial correction signals,

(d2) subtracting the full correction signal from said signal to obtain the corrected signal having the reduced crest factor, and

(d3) outputting said corrected signal.

20. The apparatus according to claim 18,

wherein the processing means are designed to repeat steps (a) to (c) for at least two iterations for each one of the plurality of partial correction signals.

21. The apparatus according to claim 20, where a maximum number of iterations is predetermined.

22. The apparatus according to claim 20,

said apparatus further comprising comparison means for comparing a maximum absolute amplitude of said partially corrected signal with a predetermined value,

said comparison means being coupled with said processing means such that steps (a) to (c) are repeated for each one of the plurality of partial correction signals until said maximum absolute amplitude of the partially corrected signal is below said predetermined value.

23. The apparatus according to claim 20,

further comprising storage means for storing the calculated amplitude and phase values in step (b), and

wherein the outputting means are designed such that they perform the steps of

(d1) calculating a plurality of further partial correction signals having the predetermined frequencies each as a superposition of the partial correction signals having the respective predetermined frequency phases and amplitudes stored in the storage means for this frequency

(d2) subtracting the plurality of further partial correction signals from said signal to obtain the corrected signal, and

(d3) outputting said corrected signal.

24. The apparatus according to claim 18,

wherein the processing means are designed such that they carry out in step (b) the steps of

(b1) calculating said amplitude according to

$$A = g \cdot \left(\max\{x(t) \cdot \cos(2\pi f(t - t\max))\} + \min\{x(t) \cdot \cos(2\pi f(t - t\max))\}\right),$$

A being the amplitude, g being a predetermined factor, f being the respective predetermined frequency, t being the time, $t\max$ being said time position and $x(t)$ being said signal, and

(b2) calculating said phase p according to $p = 2\pi f \cdot t\max$

25. The apparatus according to claim 18,

wherein the signal is a sampled signal represented as a signal vector of N signal values at N sampling times.

26. The apparatus according to claim 25,

wherein the processing means are designed to carry out, in step (b), the steps of

(b1) calculating said amplitude according to the formula

$$A = g \cdot \left(\max\{x(k) \cdot \cos(2\pi\mu(k - k\max)/N)\} + \min\left(x(k) \cdot \cos(2\pi\mu(k - k\max)/N)\}\right),$$

A being the amplitude, g being a predetermined factor, μ being a number of the respective predetermined frequency, k being a number of the sample, $k\max$ being this number of the sample at said time position, and $x(k)$ being a k-th component of said signal vector, and

(b2) calculating said phase p according to $p = 2\pi\mu \cdot k\max/N$.

27. The apparatus according to claim 26,

wherein values for μ have the form $2^{\ell} \cdot v$, ℓ and v being integer numbers.

28. The apparatus according to claim 26,

said apparatus further comprising a stored sine or cosine table for calculating cosine values of the formula.

29. The apparatus according to claim 18,

wherein the signal is a multi-carrier signal.

30. The apparatus according to claim 29,

wherein the signal is a discrete tone modulated signal.

31. The apparatus according to claim 18,

further comprising comparison means for comparing the maximum absolute amplitude determined in step (a) with a predetermined value,

said comparison means being coupled with the processing means and the outputting means such that, when the maximum absolute amplitude determined in step (a) is below a predetermined value, steps (b) to (d) are omitted and the signal is output.

32. The apparatus according to claim 25,

wherein said apparatus comprising preprocessing means for preprocessing said signal vector according to the steps of

(a1) forming a first auxiliary vector containing as elements the M signal values having the M largest absolute values of the N signal values, M being smaller than N,

(a2) forming a second auxiliary vector indicating the positions of the elements of the first auxiliary vector in the signal vector,

wherein the preprocessing means are coupled to the processing means so that the processing means perform the steps (a) to (c) on the first auxiliary vector instead of on the signal using phase information of the second auxiliary vector, and

wherein the outputting means are designed to carry out the steps of

(d1) calculating a correction vector for the signal vector based on said amplitudes and said phases calculated in step (b) translated to phases for the signal vector using the second auxiliary vector,

(d2) subtracting said correction vector from said signal vector to obtain a corrected signal vector, and

(d3) outputting a signal corresponding to said corrected signal vector as the corrected signal having the reduced crest factor.

33. The apparatus according to claim 32, wherein the processing means are designed to carry out, in step (b), the steps of

(b1) calculating said amplitude according to

$$A = g \cdot (\max\{xm(k) \cdot \cos(2\pi\mu(pm(k) - pm(k\max))/N)\} + \\ + \min\{xm(k) \cdot \cos(2\pi\mu(pm(k) - pm(k\max))/N)\}),$$

A being the amplitude, g being a predetermined factor, μ being a number of the respective predetermined frequency, k being a number of the sample, $k\max$ being the number of the sample at said time position, $xm(k)$ being element k of said first auxiliary vector, $pm(k)$ being element k of said second auxiliary vector, and

(b2) calculating said phase p according to $p = 2\pi\mu \cdot k\max/N$

34. The apparatus according to claim 32, wherein the preprocessing means are designed to carry out, in steps (a1) and (a2), the steps of:

(aa1) assigning the M last elements of the signal vector to elements of the first auxiliary vector,

(aa2) assigning the M last sample positions of the signal vector to the elements of the second auxiliary vector,

(aa3) setting a counter to 0,

(aa4) determining the element of the first auxiliary vector having the smallest absolute amplitude,

(aa5) incrementing the counter by 1,

(aa6) checking if the element of the signal vector designated by the counter has a larger absolute amplitude than the element of the first auxiliary vector having the smallest absolute amplitude, and, if not, returning to step (aa5),

(aa7) replacing the element of the first auxiliary vector having the smallest absolute amplitude by the element of the signal vector designated by the counter, and replacing the corresponding element of the second auxiliary vector by the counter,

(aa8) returning to step (aa4) until the counter has reached $N-M$.